We claim:

1. A method of forming a SiGe layer having a relatively high Ge content, comprising:

preparing a silicon substrate;

depositing a layer of SiGe to a thickness of between about 100 nm to 500 nm, wherein the Ge content of the SiGe layer is equal to or greater than 10%;

implanting H_2^+ ions through the SiGe layer into the substrate at a dose of between about $2x10^{14}$ cm^{-2} to $2x10^{16}$ cm^{-2}, at an energy of between about 20 keV to 100+ keV;

low temperature thermal annealing at a temperature of between about 200°C to 400°C for between about ten minutes and ten hours;

high temperature thermal annealing the substrate and SiGe layer, to relax the SiGe layer, in an inert atmosphere at a temperature of between about 650°C to 1000°C for between about 30 seconds and 30 minutes; and

depositing a layer of tensile-strained silicon on the relaxed SiGe layer to a thickness of between about 5 nm to 30 nm.

2. The method of claim 1 wherein said depositing a layer of SiGe includes depositing the layer of SiGe at a temperature of between about 400°C to 600°C.

3. The method of claim 1 which further includes, prior to said implanting, depositing a layer of silicon oxide on the SiGe layer to a thickness of between about 50Å to 300Å.

4. The method of claim 1 which further includes, after said high temperature thermal annealing, depositing a layer of relaxed SiGe having a thickness of at least 100nm on the relaxed SiGe layer.

5. The method of claim 1 wherein said low temperature thermal annealing is done in an inert atmosphere taken from the group of inert atmospheres consisting of argon and nitrogen.

6. A method of forming a SiGe layer having a relatively high Ge content, comprising:

preparing a silicon substrate, wherein the silicon substrate is taken from the group of substrates consisting of bulk silicon and SIMOX;

depositing a layer of SiGe to a thickness of between about 100 nm to 500 nm, wherein the Ge content of the SiGe layer is equal to or greater than 10%, by number of atoms, and where said depositing is done at a temperature in a range of between about 400°C and 600°C;

implanting H_2^+ ions through the SiGe layer into the substrate at a dose of between about $2x10^{14}$ cm^{-2} to $2x10^{16}$ cm^{-2}, at an energy of between about 20 keV to 100+ keV;

low temperature thermal annealing at a temperature of between about 200°C to 400°C for between about ten minutes and ten hours in an inert atmosphere taken from the group of inert atmospheres consisting of argon and nitrogen;

thermal annealing the substrate and SiGe layer, to relax the SiGe layer, in an inert atmosphere at a temperature of between about 650°C to 1000°C for between about 30 seconds and 30 minutes; and

depositing a layer of material taken from the group of materials consisting of tensile-strained silicon, tensile strained SiGe, compressed SiGe, and a composite stack thereof, on the relaxed SiGe layer to a thickness of between about 5 nm to 30 nm.

7. The method of claim 6 which further includes, prior to said implanting, depositing a layer of silicon oxide on the SiGe layer to a thickness of between about 50Å to 300Å.

8. The method of claim 6 which further includes, after said high temperature thermal annealing, depositing a layer of relaxed SiGe having a thickness of about 100nm on the relaxed SiGe layer.

9. A method of forming a SiGe layer having a relatively high Ge content, comprising:

preparing a silicon substrate;

depositing a layer of SiGe to a thickness of between about 100 nm to 500 nm, wherein the Ge content of the SiGe layer is equal to or greater than 10%, by number of atoms, and at a temperature in a range of between about 400°C to 600°C;

implanting H_2^+ ions through the SiGe layer into the substrate at a dose of between about $2x10^{14}$ cm^{-2} to $2x10^{16}$ cm^{-2}, at an energy of between about 20 keV to 100+ keV;

low temperature thermal annealing at a temperature of between about 200°C to 400°C for between about ten minutes and ten hours;

thermal annealing the substrate and SiGe layer, to highly relax the SiGe layer in an inert atmosphere at a temperature of between about 650°C to 1000°C for between about 30 seconds and 30 minutes; and

depositing a layer of silicon-based material on the relaxed SiGe layer to a thickness of between about 5 nm to 30 nm.

10. The method of claim 9 which further includes, prior to said implanting, depositing a layer of silicon oxide on the SiGe layer to a thickness of between about 50Å to 300Å.

11. The method of claim 9 wherein said high temperature thermal annealing is done in an inert atmosphere taken from the group of inert atmospheres consisting of argon and nitrogen.

12. The method of claim 9 which further includes, after said thermal annealing, depositing a layer of relaxed SiGe having a thickness of at least 100nm on the relaxed SiGe layer.

13. The method of claim 9 wherein said depositing a layer of silicon-based material on the relaxed SiGe layer includes depositing a layer of material taken from the group of materials consisting of tensile-strained silicon, tensile strained SiGe, compressed SiGe, and a composite stack thereof.